

## **EXHIBIT J**



**Z241.1-1999**

APPROVED October 18, 1999

# American National Standard

safety requirements

for sand excavation

and trenching operations

SAFETY REQUIREMENTS FOR SAND EXCAVATION

AND TRENCHING OPERATIONS

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## Foreword

**This foreword is not a part of the American National Standard  
Safety Requirements for Sand Preparation, Molding and Coremaking  
in the Sand Foundry Industry in the Metalcasting Industry (Z241.1-1999)**

This standard in its third revision is part of a project started in 1972 under the sponsorship of the American Foundrymen's Society, Inc. Although an independent standard, it is intended to be associated with the two other foundry standards Z241.2-1999 and Z241.3-1999. The set of three will establish safety requirements for the metalcasting industry.

The metalcasting industry shares safety considerations with many other industries requiring the movement of heavy objects, the use of large ovens and melt furnaces, and processing of hot materials. In addition, there are safety considerations common to all industries. The present trend is towards the development of industry-wide standards wherever the need for safety considerations exists. This standard, therefore, is limited to safety considerations of special importance in the metalcasting industry operations where general standards do not exist or are not considered adequate. Operating rules are not included in this standard unless they are vital to safety.

Compliance with this standard should provide a relatively safe environment, which is a fundamental requirement in preventing occupational injuries.

Suggestions for improvement or inquiries concerning application of, or the intent of this standard, should be sent to the *American National Standards Institute, 11 West 42<sup>nd</sup> Street, New York, NY 10036* or to the *American Foundrymen's Society, Inc., 505 State Street, Des Plaines, IL 60016-8399 attention EHS*.

A special thanks to the American Foundrymen's Society Safety and Health Committee (10-Q) and to the ANSI Canvas Review Committee for their expertise and time devoted to completing this project.

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## Standard Requirements

### 1. Scope, Purpose and Application

**1.1 Scope.** The requirements of this standard apply to the design, construction and operation of the machinery and equipment as listed in Section 5.3 used in the preparation of sand and in the making of sand molds and sand cores for metal casting. Diecasting machines are excluded from the requirements of this standard.

**1.2 Purpose.** The requirements of this standard, including the training of supervisors and employees, are intended to minimize the possibility of injury to operating and maintenance personnel while working on, or in the vicinity of, the specified equipment.

#### 1.3 Application

**1.3.1 New Installations.** After the date of publication, all new installations within the scope of this standard shall conform to its requirements. Any existing machine installation moved to a new plant or another location in the same plant is deemed a new installation when it is installed in the new location. However, an existing installed machine (former installation) which is moved for a short distance, for example, to provide additional aisle space, is not deemed to be a new installation.

**1.3.2 Existing Installations.** After the approval date of this standard, installations existing on, or prior to, this date, shall be modified as necessary to conform to all requirements of this standard. Those facilities and equipment on order or in the process of construction on the date of publication of this standard shall be considered as an existing installation. This standard applies to existing equipment where it lacks the necessary employee protection.

### 2. Definitions

**2.1 Anti-Tie-Down.** This requires that the two hand controls function only when both initiators have been released just prior to operation. Unauthorized tying down of one initiator to permit one hand operation by the other initiator prevents operation (see 2.68 and 2.69).

**2.2 Auger.** A rotating screw used to mix and/or transport sand, clay or other media, used in core and mold making.

**2.3 Authorized.** Having the authority delegated by the employer.

#### 2.4 Barrier Guards

**2.4.1 Adjustable Barrier Guard.** A physical barrier with adjustable sections that prevents entry of any part of the body into the hazardous zone by reaching through, over, under or around the barrier. The adjustable sections allow different jobs to be run on the equipment.

## Explanatory Information

**(Not part of American National Standard Safety Requirements for Sand Preparation, Molding and Coremaking in Metalcasting)**

**E.1.1 Scope.** Other American National Safety Standards have been developed under the Z241 series (Z241.2, Z241.3) to establish safety recommendations and equipment operations not included in this standard. When other American National Safety Standards are referenced in this standard, the latest revision of the standard is the reference.

**E.1.2 Purpose.** Compliance with this standard, in conjunction with OSHA regulations, provides a relatively safe environment, which is a fundamental requisite in helping to prevent occupational injuries.

**E.1.3.1 New Installations.** The employer should be certain that all equipment - new or used - that is installed complies with this standard. Refer to 3.1, 3.2.1.1 and 4.1.

**E.2.4.1 Adjustable Barrier Guard.** This type of guard requires close supervision of use and adjustment or inadequate protection may result. It shall be the responsibility of the employer to establish and follow a program of periodic and regular inspection of power press and auxiliary equipment. Ref. OSHA Std. 29 CFR 1910.217(e)

**2.4.2 Fixed Barrier Guard.** A securely attached physical barrier, not readily removable, that prevents entry of any part of the body into the hazardous zone by reaching through, over, under, or around the barrier.

**2.4.3 Interlocked Barrier Guard.** A barrier interlocked with the machine power or control so that the machine cycle will stop and cannot be initiated with the operating controls unless the guard, or the hinged or movable sections, effectively encloses the hazardous zone.

**2.5 Blow Plate.** A plate affixed to the magazine or blow head of a core or mold blowing machine having holes or slots through which sand or other media in the magazine or blow head passes into the core or mold cavity or around the pattern when air or other gas pressure is applied to the machine.

**2.6 Clamp Frame.** A moving frame on a core blowing machine which moves the corebox and presses it against the blow plate.

**2.7 Clearance Line.** A line, which marks the distance, required to prevent contact between a guard(s) and moving parts.

**2.8 Consensus Standards.** A standard for which consensus must be reached by those having substantial concern with its scope and provisions. Consensus standards as used in this standard refer to those standards developed under the auspices of an approved standards writing organization.

**2.9 Core.** A preformed aggregate or collapsible insert placed in a mold to shape the interior or that part of a casting, which cannot be shaped by the pattern.

**2.10 Core or Mold Blowing or Shooting Machine.** A machine for injecting sand or other media into the core or mold cavity by means of compressed air or other gas.

**2.11 Corebox.** A (wood, metal or plastic) structure, the cavity of which has the shape of the desired core which is to be made therein.

**2.12 Core Binder(s).** Any material, liquid or solid, which is used to bond core aggregates.

**2.13 Employee.** A person employed in a position below the supervisory level.

**2.14 Employer.** Any person, persons, or entity that hires and/or directs the activity of personnel.

**2.15 Exhaust System.** A system of air moving equipment and ducts used to remove airborne contaminants from affected areas.

**2.16 Explosion Vent.** A part of an enclosure or container designed to release pressure rapidly.

**2.17 Flame Detector.** A device, which senses the absence or presence of flame, for the purpose of controlling fuel line valves.

**2.18 Flask.** A container, without top or bottom, used to contain the sand or other media while it is being formed. It is made in two or more parts, the lower part called the drag and the upper part called the cope. Intermediate sections, if any, are called cheeks.

**2.19 Flask Clamp.** A device used to lock together two or more flask sections.

**2.20 Flask Sling.** Chains, rods, bails, cables, and other materials used to support a load such as a flask for turning, inverting or transporting.

**2.21 Fuel Fired Equipment (Enclosed).** A specially heated chamber such as core oven, drying oven, thermal sand reclamation, sand heater or annealing oven.

**2.22 Guarded.** Shielded, fenced, enclosed or otherwise protected by means of suitable enclosure, covers, casing, shield guards, trough guards, barrier guard, railing guards, or guarded by location, or other protective devices, so as to reduce the possible risk of personnel injury from accidental contact or approach, or in the case of spill guards so as to reduce possibility of personnel injury from material being spilled into the area protected. Where it is not feasible to guard against the hazard, or where the guard itself creates a hazard, the potential hazard shall be marked prominently to warn of its existence.

**2.23 Guarded by Location or Position.** In order to be guarded by location or position according to height above a walkway, platform or workspace, any moving part shall be at least 8 feet (2.46 meters) above same. However, pinch points of all descriptions and moving projections shall not be guarded by location unless they are a minimum of 9 feet (2.74 meters) above the pertinent floor.

When moving parts are remote from floors, platforms, walkways, other working levels or by their location with reference to frames, foundations, or structures which minimize the probability of accidental contact by personnel, they shall be considered to be guarded by position or location. Remoteness from regular or frequent presence of public or employed personnel may, in reasonable circumstances, constitute guarding by location.

**2.24 Hazard Point.** The closest point within the hazardous zone at which physical contact occurs between machine elements and/or materials.

**2.25 Hazardous Zone.** That area within the operator's work zone where bodily injuries may be encountered.

**2.26 Hostage Control.** A type of control in which the physical act of operating the initiator prevents operator exposure to the motion or response produced by the initiator.

**E.2.25 Hazardous Zone.** The European Committee for Standardization (CEN) defines danger zone as "any zone within and/or around machinery in which a person is exposed to risk of injury or damage to health" and hazard as a "source of possible injury or damage to health".

**E.2.26 Hostage Control.** An initiator located a sufficient distance from the hazardous zone that the operator cannot reach the point of operation during the hazardous portion of the cycle, after operating the initiator, is an example.

**2.27 Inch Initiator.** A hostage control, which causes machine motion in single or repeated small increments only when controlled by manual pressure. It is intended for use in setup or maintenance, but not in normal operation.

**2.28 Initiator.** A device that causes an action.

**2.29 Inspections, Frequency of.** Frequent - daily to monthly intervals. Periodic = from one (1) to twelve (12) month intervals.

**2.30 Interlock.** A device in a system which, when actuated, permits or prevents the operation of one or more components in the system.

**2.31 Investment Mold.** A flowable mixture of a graded refractory filler, a binder and a liquid vehicle which when applied around the patterns conforms to their shape and subsequently sets hard to form the investment mold.

**2.32 Main Burner.** Primary combustion device commonly ignited by a secondary source.

**2.33 Mandatory Safety Standards.** Those safety standards that are legally enforceable by agencies of federal, state or local government.

**2.34 Manually Powered Machines.** A machine in which the operator provides the motive power to operate the machine.

**2.35 Minimum Guarding Line.** That distance between the point of entry side of the guard and the hazard point.

**2.36 Mixer.** A machine which blends, coats, kneads, or mechanically combines various sand(s) or other media used for foundry purposes with binders and other additive agents.

### **2.37 Mode of Operation**

**2.37.1 Manual.** Each machine function in the machine cycle and load cycle is manually initiated and controlled in the sequence, or out of the sequence of the normal machine cycle.

**2.37.2 Semi-Automatic.** At least one machine function in the cycle is automatically performed and sequenced, but which requires the operator to initiate at least one function manually.

**2.37.3 Automatic.** Each function in the machine cycle is initiated by the previous cycle and is automatically performed and sequenced, including load, unload and repeat cycle.

**2.38 Mold.** The form that contains the cavity into which molten metal is poured to produce a casting of definite shape and outline.

**E.2.28 Initiator.** Typical operator initiators are pushbuttons, foot switches, manual starters, hand valves and other valves with manual overrides. Typical non-operator initiators are limit switches, pressure switches, temperature-actuated switches, flow switches and cam-actuated valves.

**E.2.36 Mixer.** Typically, it consists of a circular container in which are mounted rotating plows and/or mill wheels (mullers). The two terms are frequently used interchangeably, but "mixer" should be reserved for machines without mill wheels.



**2.39 Molding Machine.** A machine for compacting molding media (usually sand) about the pattern(s), thus forming the mold.

**2.40 Moving Frame.** That part of a molding machine which supports the flask and imparts the motions necessary to the moldmaking process.

**2.41 Muller.** A machine which blends, coats, kneads or mechanically combines various sand(s) or other media used for foundry purposes with binders and other additive agents.

**2.42 Nip Zone.** A point or zone where a portion of the body may be caught hold of and squeezed between two surfaces, edges or points.

**2.43 Operator's Work Zone(s).** The operator's work zone(s) of equipment is that area in which the operator's presence is required, while operating in the intended manner.

**2.44 Pattern.** A form of wood, metal or other materials against which molding material is compacted to make a mold for casting metals.

**2.45 Pilot (Flame or Spark).** An auxiliary source which ignites the main burner.

**2.46 Pinch Zone.** A zone where a portion of the body may be caught and injured between surfaces, edges or points.

**2.47 Point of Operation.** That point or zone in which the principal operation is being performed.

**2.48 Power Off or Out.** The state in which power cannot flow to the equipment from the source (see 3.4).

**2.49 Power Locked Off.** The state in which the device that turns power off is locked in the off position with the padlock of every individual who is working on the machine.

**2.50 Presence Sensing Device.** A device designed, constructed and arranged to create a sensing field or area that will detect either the presence or absence of personnel.

**2.51 Protection from Unexpected Machine Movement.**

**E.2.41 Muller.** Typically, it consists of a circular container in which are mounted rotating plows and/or mill wheels (mullers). The two terms are frequently used interchangeably, but "mixer" should be reserved for machines without mill wheels.

**E.2.43 Operator's Work Zone(s).** An employee's presence applies to the entrance into the operator's work zone of the employee's body or any part thereof.

**E.2.45 Pilot (Flame or Spark).** This should not be confused with tapered pins and bushings that guide machine or flask elements.

**E.2.48 Power Off or Out.** Electrical: A disconnect switch is OPENED to turn power OFF or to lock it OUT-to prevent electricity from flowing to the machine.

Fluid Power (Air, oil, other): A shutoff valve is CLOSED to prevent the fluid from flowing to the machine.

The use of "open" in one case and "closed" for the other-for the same purpose-may be confusing and should be avoided. Use "Switch (electrical) locked OFF or OUT" (meaning open), "Valve (fluid power) locked OFF or OUT" (meaning closed).

**E.2.50 Presence Sensing Device.** A mat that responds to the operator's weight, a light ray that is interrupted by his body, or an electromagnetic (radio capacitance) field that responds in a similar fashion are examples of presence sensing devices.

**E.2.51 Protection from Unexpected Machine Movement.** There are hazards other than unexpected movement, and the OSHA machine lockout/tagout standard 1910.147 includes protection against such other hazards.



**2.51.1 Protection - Primary.** A state in which the primary source(s) of power has been isolated by being locked out (off), and in which stored energy in the machine has been dissipated, constrained or controlled. The state in which OSHA Lockout/Tagout has been established.

**2.51.2 Protection - Secondary**  
Limited protection by control devices.

**2.52 Protective Device.** A means whereby personnel access to a hazardous zone or area is denied by other than a physical guard.

**2.53 Puncture Zone.** A zone in which a portion of the body may be punctured or perforated.

#### **2.54 Qualified Engineer/Person**

**2.54.1 Qualified Engineer.** A qualified engineer is one who possesses an engineering degree from an accredited institution of higher learning or a certificate of professional standing, and has engineering experience with the kind of work and equipment involved.

**2.54.2 Qualified Person.** A person determined by the employer to have the training and/or experience to operate and/or maintain the equipment involved.

**2.55 Reclaimed Sand.** Used foundry sand, which has been reprocessed by thermal, air or hydraulic methods so that it may be used in place of new sand without substantially changing current foundry sand practice.

**2.56 Safe, Safety.** The state of being reasonably free or reasonably protected from injury or risk. Never to be construed as absolute or perfect protection from harm, injury or risk. When used, it assumes and is dependent upon prudent behavior, use of personal protective equipment commonly associated with the action or area, and in some cases presumes only trained personnel will do the work.

**2.57 Sand.** Loose granular material resulting from the disintegration of rock. The name sand refers to the size of the grain and not to the mineral composition. The diameter of the individual grains can vary from approximately 6 to 270 mesh.

**E.2.51.1 Protection - Primary.** Locking off the power to an electric drive motor by means of the main disconnect switch is an example of primary protection against hazards related to the running of the motor. Putting a machine in OSHA Lockout/Tagout is a further example of such primary protection for a fluid powered machine.

**E.2.51.2 Protection - Secondary.** Control devices, like limit switches, can malfunction mechanically or electrically, can be frustrated by a ground or short circuit in the wiring to them, and interlocks intended for safety purposes are often by-passed or wedged or tied in actuated states. Secondary protection is only justifiable when there is no practical alternative - that is, when primary protection is not practical, and when regular disciplined maintenance is present. The operator, whose constant attitude should be one of caution, should understand the fact that operator protection devices such as interlocked guards are secondary protection. Frequent inspections of such protective devices should be made. Locking a STOP push button in the actuated position instead of using OSHA Lockout/Tagout is an example of a dangerous attempt to use secondary protection against machine movement.

**E.2.52 Protective Device.** Protective devices may include, but are not limited to, two hand controls, two hand trips, and hostage controls.

**E.2.56 Safe, Safety.** The terms safe and safety only apply to the area, task or equipment so characterized and to the recognized hazard for which the standard is intended. Safety is used in the sense of comparative forms of the word, recognized by the dictionary entries of "safe, safer, safest," implying degrees of freedom or protection.

**2.58 Sand Mixer, Sand Muller.** A machine for conditioning mold and core sand by controlled mixing with additives.

**2.59 Sand System.** That part of a foundry installation that processes and transports sand or other media in bulk form.

**2.60 Screen (Sand).** A sieve or riddle with openings of definite size used to separate one grain size from another or to remove lumps and foreign objects from sand.

**2.61 Shall.** The word "shall" means a mandatory requirement.

**2.62 Shear Pin.** A pin built into a mechanism designed to fail under specified loading and act as an overload disconnect.

**2.63 Shear Zone.** A point or zone where body parts may be caught by one machine member moving past another.

**2.64 Should.** The word "should" denotes a recommended safety practice, but one that is not mandatory.

**2.65 Slinger.** A machine which throws sand or other media into a flask, corebox or other container.

**2.66 Slip Clutch.** A shaft-coupling device designed to slip when overloaded.

**2.67 Stop Block.** A restraining device which will prevent hazardous movement of a machine or equipment member(s).

**2.68 Two Hand Maintained Initiators.** Type of control in which the operator causes a motion by manually operating an initiator concurrently with each hand, the motion stopping or reversing upon deactuation of either or both initiators.

**2.69 Two Hand Momentary Initiators.** Type of control in which the operator causes a motion by manually operating an initiator concurrently with each hand, the motion continuing to completion whether the initiators continue to be held actuated or not.

**2.70 Zero Mechanical State**  
NOW SUPERSEDED BY OSHA LOCKOUT/TAGOUT  
(STANDARD CFR 1910.147)

**E.2.68 Two Hand Maintained Initiators.** Often referred to as "two hand control device."

**E.2.69 Two Hand Momentary Initiators.** Often referred to as "two hand trip device".

**E2.70 ZMS first appeared in an AFS standard in 1975 (ANSI Z241.1).** The first general lockout procedure for machines powered by electric and/or fluid power. This lockout was pioneered by AFS. ZMS required that potential and kinetic energy be reduced, dissipated, or controlled before servicing in order to avoid injury from unexpected or inadvertent movement.

ANSI Z244.1 (*not Z241.1*) Safety Requirements for Lockout/Tagout of Energy Sources was first published in 1982.

OSHA Standard CFR 1910.147 Machine Lockout/Tagout, Control of Hazardous Energy Sources, was first published in 1989.

### 3. Construction, Reconstruction and Modification.

**3.1 Responsibility.** It shall be the responsibility of any person constructing, reconstructing or modifying any equipment covered by this standard to:

(1) Design, construct and modify equipment in accordance with the provisions of this standard.

(2) Select and include in construction only components that have a working rating equal to or greater than required to meet the maximum recommended operating condition(s).

(3) Furnish printed instructions with each unit of equipment. The instructions shall include:

(a) Engineering drawings and other materials required to properly install and place such equipment into operation.

(b) Operating and maintenance instructions as specified in Section 4 of this standard.

(c) Spare parts lists.

(d) Clear definition and description of the procedures that are recommended to put the equipment in compliance with OSHA Lockout/Tagout Standards before certain maintenance and servicing operations are performed.

(4) Apply warning signs to those portions of equipment that might create unexpected hazardous conditions when power is locked out but OSHA Lockout/Tagout has not been applied.

(5) Apply legible identification plate to each piece of equipment. This plate shall include as a minimum the manufacturer's name, equipment type and/or model identification, serial number and rated capacity(s).

(6) Insure that any modification(s) or alteration(s) to a piece of equipment or machinery covered by this standard which result in a change from the manufacturer's original design and/or intended method of operation shall be done under the supervision of a qualified engineer and shall comply with mandatory safety standards for that given category of equipment. An additional legible identification plate shall be attached to the machine or equipment adjacent to the manufacturer's original identification plate (Item 5 of this section). The new identification plate shall state the date the modification(s) was made and the person or organization responsible.

### 3.2 Inherent Hazards

**3.2.1 Hazards to Personnel Associated with Moving Parts.** Hazards to personnel associated with moving parts (other than point of operation hazards) shall be guarded.

#### E.3.1 Responsibility.

(1) Consideration should be given to other applicable safety standards.

(3) To minimize hazards it is essential that this material be readily available to maintenance, operations and engineering personnel.

(4) Refer to ANSI Z535.1,.2,.3,.4,.5 for requirements and recommendations. Together these five standards contain information needed to specify formats, colors, and symbols for safety signs used in environmental and facility applications, product applications and accident prevention signs.

(6) Restrictions on modifications or alterations are not intended to bar repair or maintenance including the substitution of substantially equivalent components.

#### E.3.2.1. Hazards to Personnel Associated with Moving Parts.

Some examples of hazards to personnel associated with moving parts are:

(1) Rotating components, such as flywheels, gears, sheaves, and shafts in close proximity to personnel;

(2) Run in pinch points, such as meshing gears, belts and chains; and

(3) Pinch points between the moving and stationary components of the machine.

Refer to ANSI B15.1 and ANSI B20.1 for recommendations and requirements.

### 3.2.1.1 Responsibility

**3.2.1.1.1 Manufacturer.** The manufacturer shall endeavor to eliminate the hazards by design or provide protection against them. In cases in which the hazards cannot be eliminated by design or protection within practical limits, the manufacturer shall warn against them by using signs.

**3.2.1.1.2 Employer.** Equipment with moving parts that could cause injuries to personnel shall be guarded.

**3.2.2 Hazards to Personnel Associated with the Point of Operation.** Refer to Section 5.

**3.2.3 Hazards to Personnel Associated with Broken, Falling or Flying Machine Components.** The manufacturer shall design, secure, or cover machine components to minimize hazards caused by falling or flying components resulting from loosening or breakage.

### 3.3 Installation

**3.3.1 Employer Responsibility.** The employer shall be responsible for safe conditions for installing the equipment covered by this standard.

**3.3.2 Safeguarding During Construction, Reconstruction or Modification.** Use of barriers, shields, covers over excavations, pits or tanks shall be required and used. Means shall be provided to prevent unauthorized persons from entering an area or zone in which construction or repair is in progress.

**3.3.3 Work Station.** Each workstation shall have space to permit work without physical interference from equipment or another employee(s). Services, including electric power, air hydraulic, water, steam or process liquids, shall be delivered in identified conductors with shut-off valves or disconnecting means legibly marked, and shall be visible and accessible.

### 3.4 Power Requirements

**3.4.1 Disconnect Means.** All Motors, motor circuits, and controllers shall have disconnecting means as required by Article 430, of the National Electric Code (ANSI/NFPA 70 published by the National Fire Protection Association). The disconnecting means shall be capable of being locked in the (OFF) position.

**3.4.1.1 Disconnect Means Identification.** Each disconnect means shall be marked with legible durable label that identifies the voltage and equipment controlled. Identification shall be verified at time of installation.

#### 3.4.1.2 Disconnection.

(a) Control circuits shall be so arranged that they will be disconnected from all sources of power when disconnecting means is in the open (OFF) position.

(b) There should be an interlock, on separate power source feeds, that opens when the main disconnect is opened.

**E.3.2.1.1.1 Manufacturer.** Refer to ANSI Z535.1,.2,.3,.4,.5 for requirements and recommendations. Together these five standards contain information needed to specify formats, colors, and symbols for safety signs used in environmental and facility applications, product applications and accident prevention signs.

**E.3.2.1.1.2 Employer.** Hazards created by moving transfer equipment may be guarded by standard railing.

**E.3.3.3 Work Station.** Refer to ANSI A12.1 for requirement and recommendations.

**E 3.4.1.2 Disconnection** The disconnecting means can consist of two or more separate devices, one of which disconnects the motor and the controller from the source(s) of power supply for the motor, and the other disconnects the control circuit(s) from its power source. Where separate devices are used, they shall be located immediately adjacent, one to the other.

**3.4.1.3 Disconnection Hazards.** Where the operation of a disconnecting means could create a hazard, a suitable warning nameplate shall be provided and located adjacent to the label identifying the disconnect.

**3.4.1.4 Motor Starting Equipment.** Motor starting equipment which can restart a motor automatically after an unplanned power interruption or power outage shall not be used, when automatic restarting can result in injury to personnel. It shall be necessary to manually restart the motor.

**3.4.2 Fluid Power Off.** Means shall be provided for isolating fluid (air, oil or other) energy sources from a machine, or group of machines, controlled as a system. These means shall have provisions for being locked in the isolating mode. Pressure build-up on the machine side port of the isolating means shall be eliminated by positive means, such as venting to atmosphere or drainage to tank.

**3.5 Electrical Equipment Grounding.** All electrical equipment, shall be grounded in accordance with the National Electrical Code.

**3.6 Fluid Exhaust (Gas or Liquid).** The employer shall be responsible for arranging conductors to direct the exhaust of fluids to a location(s) that will not create a hazardous condition.

#### **4. Care of Equipment**

##### **4.1 Responsibility**

###### **4.1.1 Instructions**

**4.1.1.1 Manufacturer.** It shall be the responsibility of the manufacturer to furnish operating and maintenance instructions with equipment covered by this standard. This shall include recommendations for OSHA Lockout/Tagout.

**4.1.1.2 Modification/Reconstruction.** It shall be the responsibility of any person modifying or reconstructing any piece of equipment covered by this standard to furnish operating and maintenance instructions, including updated functional engineering drawings of controls covering the modified portion of the equipment.

**4.1.1.3 Employer.** It shall be the responsibility of the employer to specify corrective maintenance procedures for the equipment covered by this standard that minimize hazards to operating and maintenance personnel.

**4.1.2 Installation.** It shall be the responsibility of the employer to provide work areas around the equipment covered by this standard to minimize hazards to operating and maintenance personnel.

**E.4.1.1.1 Manufacturer.** Specific operating and maintenance instructions should be outlined in the operating and maintenance manuals to aid operators and maintenance personnel in the proper operation and maintenance of the equipment. Adequate instructions may consist of written, illustrated, audio, and visual recorded material. However, the employer is responsible for making sure all equipment is adequately guarded and safe for operation.

**E.4.1.1.2 Modification/Reconstruction.** Many modification and rebuilding efforts are so extensive that the original instructions from the manufacturer are incorrect or meaningless. Refer to Section 3 of this standard.

ANSI STANDARD Z241.1

**4.1.3 Inspection and Preventive Maintenance.** It shall be the responsibility of the employer to establish and supervise a program of inspections and preventive maintenance of the equipment covered by this standard. Designated personnel shall perform the inspections and maintenance required by Section 4 of this standard.

**4.1.4 Maintenance Personnel Training and Experience.** It shall be the responsibility of the employer to provide competent personnel for maintaining the equipment covered by this standard.

#### **4.1.5 Startup Procedures**

**4.1.5.1 Manufacturer.** It shall be the responsibility of the manufacturer to recommend a startup procedure that minimizes hazards.

**4.1.5.2 Employer.** The employer shall establish and follow a startup procedure considering the manufacturers recommendations before any equipment covered by this standard is placed in regular operation.

**4.1.5.3 Employee.** It shall be the responsibility of the employee to follow the start-up procedure established by the employer.

#### **4.1.6 Shutdown Procedure.**

**4.1.6.1 Manufacturer.** It shall be the responsibility of the manufacturer to recommend a shutdown procedure that minimizes hazards.

**4.1.6.2 Employer.** The employer shall establish and follow a shutdown procedure considering the manufacturer's recommendations prior to necessary lockouts before allowing any inspection, adjustments or maintenance of the equipment covered by this standard.

**4.1.6.3 Employee.** It shall be the responsibility of the employee to follow shutdown, lockout and safeguarding procedures established by the employer.

#### **4.1.7 Troubleshooting, Maintenance and Repair**

**4.1.7.1 Employer.** The employer shall provide a means of monitoring the activities of employees engaged in troubleshooting, maintenance or repair in isolated, confined space, or hidden areas.

**4.1.7.2 Employee.** The employee shall use the monitoring means established by the employer to inform others of his presence when performing maintenance or setup work in hidden or isolated areas.

**E.4.1.3 Inspection and Preventive Maintenance.** The frequency of inspecting the equipment should be based on the manufacturer's recommendations, the number of hours used per month, and the maintenance history. The employer should schedule frequent and/or periodic inspections that would reveal hazards caused by age, overloading, corrosion, fatigue, improper use, or improper installation.

**E4.1.4 Maintenance Personnel Training and Experience.** Competent maintenance personnel should have the technical background necessary to understand the information contained in the maintenance manuals for the machine they are inspecting or maintaining.



**4.1.7.3 Physical Entry into Machine or Equipment.**

The employee shall follow established lockout/tagout and confined space procedures for the machine or equipment prior to physical entry.

**4.1.7.4 Troubleshooting, Maintenance and Repair with Power On.**

**Exception for qualified persons only:** When necessary to locate and define problems and make adjustments with power on, work may be performed by a qualified person on machines or equipment with guards removed or within areas protected by barriers, if protective measures have been taken to train and supervise the employees to not place any part of the body in the path of any movable machine or equipment member, or in contact with any hazardous energized electrical equipment.

**4.1.7.5 Defeating Protective Devices.** No employee other than qualified personnel performing special maintenance shall remove, bypass or alter any device, which was provided to reduce hazardous conditions.

**4.1.7.6 Returning Equipment to Production.** The employee shall verify that the machine or equipment has all guards secured in place before releasing it for production use.

**4.1.7.7 Use of Special Tools.** The employee shall use special tools, and/or equipment provided by the employer for performing designated maintenance functions on equipment.

**5. Safeguards****5.1 Responsibility**

**5.1.1 Manufacturer.** The manufacturer of equipment shall furnish equipment that complies with mandatory safety standards for that given category of equipment.

**5.1.2 Employer.** The employer shall be responsible for the installation and maintenance of guards, shields or barriers, and for maintaining the condition and position of such devices to protect against recognized hazardous conditions. The employer shall be responsible for providing, installing, and maintaining any additional guards required to provide protection against recognized hazardous conditions created by the use and/or installation of the equipment.

**E4.1.7.3 Physical Entry into Machine or Equipment.** Rules for confined space and/or permitted confined space may also apply.

**E.4.1.7.4 Troubleshooting, Maintenance and Repair with Power On.** A machine or piece of equipment may have to be stopped and locked out, using the OSHA Lockout/Tagout standard procedure before removing a guard or barrier so that the machine or equipment may subsequently be observed with power on.

**E.4.1.7.5 Defeating Protective Devices.** This standard does not condone defeating any protective device at any time. It does, however, recognize maintenance conditions when the protective device may need to be bypassed by authorized maintenance personnel. Under such conditions, Paragraph 4.1.7.4 must be strictly followed.

**E.4.1.7.7 Use of Special Tools.** The desire to return equipment to productive operation should not prompt any personnel to use, encourage, or condone the use of hazardous methods or improper tools to perform maintenance.

**E.5 Safeguards.** Special attention should be given to the definitions "protection-primary" and "protection-secondary".

**E.5.1 Responsibility.** It must be understood that in the application of the standard there are responsibilities incumbent upon the employer, the manufacturer, the installer, and the operator of foundry equipment. Some safety features are incorporated in the design of the equipment. Some protection depends on installation after assembly of all of the associated components in the field. Some safety features are a part of a building or structure and are not an integral part of the components themselves. Some protection depends on the operation and maintenance by the employer and operators. Some protection depends on training and supervision.

**5.2 Guarding Within the Operator's Work Zone(s).** Potential hazards including, but not limited to, nip, pinch, shear, puncture and/or catching points or zones in the operator's work zone shall be guarded against by a barrier guard or a protective device(s).

Specific equipment and its potential hazards are listed in Section 5.3 of this standard.

**Exception** - The requirement does not apply when:

(1) The exposed pinch point openings conform to Table 1 and Fig. 1. Figure 1 shows the accepted safe openings at the bottom edge of a guard at various distances from the hazard point.

(2) Manual operation, such as placing copes on drags, manually closing molds, with or without mechanical assists, shall be excluded from mandatory guarding where variable conditions preclude the use of barriers or devices. For these operations, special emphasis shall be given to operator training.

**Table 1**  
**Accepted Safe Opening Between Guard and Hazard Zone.**

Source: 29 CFR 1910.217 Table 0-10 and  
Alliance of American Insurers

Distance of Opening from Hazard Zone		Maximum Width of Opening	
(inches)	(mm)*	(inches)	(mm)*
1/2 - 1-1/2	13 - 38	1/4	6
1-1/2 - 2-1/2	38 - 64	3/8	10
2-1/2 - 3-1/2	64 - 89	1/2	13
3-1/2 - 5-1/2	89 - 138	5/8	16
5-1/2 - 6-1/2	138 - 165	3/4	19
6-1/2 - 7-1/2	165 - 191	7/8	22
7-1/2 - 12-1/2	191 - 318	1-1/4	32
12-1/2 - 15-1/2	318 - 394	1-1/2	38
15-1/2 - 17-1/2	394 - 445	1-7/8	48
17-1/2 - 31-1/2	445 - 800	2-1/8	54

\*approximate

### 5.2.1 Hazardous Zone Guarding

**5.2.1.1 Hazardous Zone Guard(s).** Every hazardous zone guard shall meet the following design, construction, application, and adjustment requirements:

(1) It shall prevent entry of any part of the body into the hazardous zone by reaching through, over, under or around the guard.

(2) It shall conform to the maximum permissible openings shown in Table 1 and Fig. 1.

(3) It shall not create pinch points.

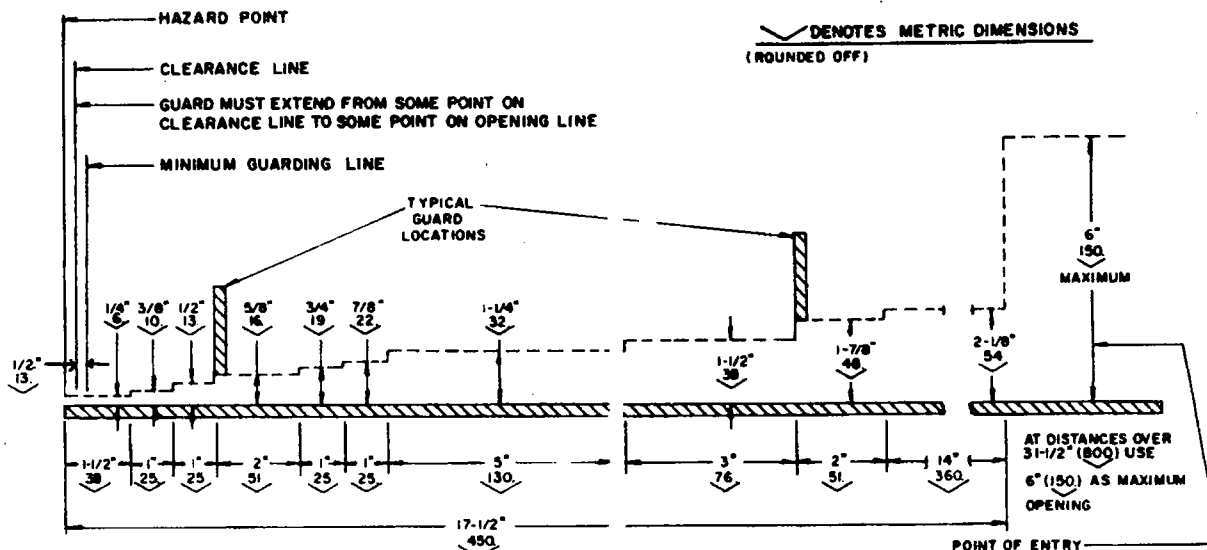
(4) It shall not be readily removable.

(5) It shall offer maximum visibility of the equipment operation consistent with the other requirements.

(6) It shall be inspected at intervals as outlined in OSHA Std. 29 CFR 1910 or ANSI standards.

**E.5.2.1 Hazardous Zone Guarding.** Guarding within that area of the operator's work zone where the work process is being performed





**Fig. 1. Positioning of guards.**

Source: 29 CFR 1910.217 and Alliance of American Insurers

**5.2.1.2 Barrier Guard(s).** Barrier guards shall meet the following criteria:

- (1) Prevent bodily entry into the process pinch or shear point by reaching through, over, under or around the guard during the production cycle, and
- (2) Conform to the maximum permissible openings shown in Table 1 and Fig. 1 and
- (3) In itself, create no pinch point between the guard and moving machine parts, and
- (4) Utilize fasteners not readily removable by the operator, so as to minimize the possibility of misuse or removal of essential parts, and
- (5) Be readily inspected for its effectiveness, and
- (6) Offer maximum visibility of the hazardous zone consistent with the other requirements.

**5.2.1.3 Fixed Barrier Guards.** A fixed barrier guard, when used, shall meet the criteria of (1) through (5), Section 5.2.1.1, and shall be attached securely.

**5.2.1.4 Interlocked Barrier Guards.** An interlocked barrier guard, when used, shall meet the requirements of (1) through (6), Section 5.2.1.1, and shall be interlocked with the machine power or controls so that the machine will not operate unless the hinged or movable section of the guard is in the closed position(s). An authorized employee shall inspect the interlock device at the beginning of each shift of operation and immediately report any damage or malfunction of the device to his supervisor. If an interlocking device is found to be ineffective, the machine shall not be put into operation.

**5.2.1.5 Adjustable Barrier Guards.** An adjustable barrier guard shall be securely attached, and shall meet the criteria of (1) through (5), Section 5.2.1.1.

**E.5.2.1.2 Barrier Guard(s).** Care should be taken to ensure that the guard itself has no sharp edges, burrs, etc., which could be a hazard.

**E.5.2.1.3 Fixed Barrier Guards.** Addition of an interlock to a fixed barrier guard does not necessarily make this an interlocked barrier guard.

**E.5.2.1.4 Interlocked Barrier Guards.** The hinged or removable section(s) of this guard are intended for use when frequent access is required.

**E.5.2.1.5 Adjustable Barrier Guards.** The adjustment and operation of the adjustable barrier guard should be closely supervised, or inadequate safeguard may result.

**5.2.2 Hazardous Zone Protective Devices.** A hazardous zone device shall protect the operator and other personnel in the area by:

(1) preventing or stopping the equipment motion or condition that would create a hazard or pinch point, if any portion of the body is in the hazardous zone, or

(2) Preventing personnel from inadvertently reaching into the hazardous motion that has started or been initiated, or

(3) Requiring personnel to position all parts of the body away from possible hazardous conditions and position both hands on initiators during the period of time that pinching motions or hazardous conditions may occur, or

(4) Requiring personnel to move away from the area of possible hazardous conditions and activate an initiator at a remote location (hostage control) or

(5) The employer shall be responsible for enforcing a rule that actuation of equipment controls be made only by the operator. An operator shall not be assisted by another employee operating the equipment controls.

**5.2.2.1 Presence Sensing Hazardous Zone Device.**

A presence sensing hazardous zone device, when used, shall protect the operator by deactivating the machine or equipment motion when the presence of personnel is detected in the hazardous zone.

(1) This device shall not be installed, connected or used in a manner, which could create any hazard to the operator.

(2) This device shall not be used as an initiator of any motion or function being protected by the device. Where or when the device is used to prevent the closing of a machine on an operator's body part, withdrawal of the operator's hands shall not automatically re-start the cycle.

(3) To the extent permitted by current recognized design techniques, this device shall be designed and applied so that any malfunction or failure of the device would prevent or stop the function or motion in the area being protected by the device.

(4) This device shall be installed, adjusted, and maintained only by authorized competent personnel.

**5.2.2.2 Hostage Controls.** Hostage controls, shall be one or more of the following types of initiators:

**5.2.2.2.1 Two Hand Maintained Initiators.** A two hand maintained initiator shall be designed, installed and connected to protect the operator by requiring application of both of the operator's hands to the machine operating initiators until the hazardous portion of the cycle is completed and shall be equipped with anti-tie-down features. Each hand control shall be protected against unintended activation, and arranged by design, construction and/or separation so that the concurrent use of both hands is required to initiate the equipment.

**E.5.2.2. Hazardous Zone Protective Devices.** Hazardous zone devices do not offer the degree of protection provided by a guard. These devices are secondary protection and may be used alone or in multiples to create the greater degrees of protection.

(4) Hostage controls must be located so that inadvertent entry into pinch points by parts of the body is prevented. The possibility of stumbling, slipping or fatigue must be considered in control placement. Hostage controls can be classed as a guard device if their location provides unimpeded access and visibility for the operator to the hazardous zone and are located so that possible pinch points or hazardous conditions cannot be reached.

**E.5.2.2.1 Presence Sensing Hazardous Zone Device.**

These devices are necessarily secondary protection. Their value is dependent upon their correct adjustment and maintenance.

(3) Although there is much talk about "fail-safe", there cannot be such an absolute condition. Single failures of device components should result in stopping or prevent initiation.

(4) These devices are necessarily secondary protection. Their value is dependent upon their correct adjustment and maintenance

**5.2.2.2.2 Two Hand Momentary Initiators.**

A two hand momentary initiator shall protect the operator by requiring that the single cycle initiators be operated at a position so that the operator cannot reach into the hazardous zone during the hazardous portion of the cycle. Two hand momentary initiators shall be equipped with anti-tie-down feature. Each hand control shall be protected against unintended activation, and arranged by design, construction and/or separation so that the concurrent use of both hands is required to initiate the equipment.

**5.2.2.2.3 Single Maintained or Momentary Initiator.**

A single maintained or momentary initiator shall protect the operator by permanently locating the single cycle operating initiator remote from the hazardous zone so that the machine completes its hazardous portion of the cycle before the operator can place any part of his body into the hazardous zone. All single maintained or momentary initiators shall be protected against unintended activation.

**5.2.2.2.4 Additional Initiators.**

In an operation requiring more than one (1) operator, separate hostage controls shall be provided for each operator.

**5.2.2.3 Hand Positioning Tools.**

Hand positioning tools shall not be used in lieu of guards or protective devices.

**5.2.2.4 Stop Block****5.2.2.4.1 Stop Block - Manual.**

A manual stop block shall be used to eliminate potential pinch points where setup or maintenance work necessitates exposure of personnel in the hazardous zone.

**5.2.2.4.2 Stop Block - Mechanical.**

Properly designed mechanical stop block devices may be used in lieu of hazardous zone protective devices. When used, it shall stop a motion that might cause injury or create a hazardous condition.

(1) A mechanical stop block device shall, in itself, create no pinch points between the device and equipment parts.

(2) It shall utilize fasteners not readily removable by the operator.

(3) An authorized person shall inspect the device daily and immediately report any damage or malfunction of the device to his supervisor.

**E.5.2.2.2.3 Single Maintained or Momentary Initiator.**

This type of initiator may be a pushbutton, foot switch, knee switch, etc. Foot switches on mechanical connectors do not meet this requirement.

**E.5.2.2.3 Hand Positioning Tools.**

Hand positioning tools, such as pliers, tongs, forceps, and specially designed devices are commonly used for placing, positioning or moving materials into or away from hazardous locations.

**E.5.2.2.4.2 Stop Block**

Properly designed means designed and built to withstand the forces to which it will be subjected.

**5.3 Specific Equipment Safeguards****5.3.1 Sand Handling and Preparation****5.3.1.1 Silos, Hoppers and Bins.**

Silos, hoppers and bins are confined spaces and may also be hazardous confined spaces. Refer to OSHA Std. 29 CFR 1910.146 for entry procedures. Refer to OSHA Std. 29 CFR 1910.147 for lockout/tagout procedures.

**5.3.1.2 Gates (Closures).** All nip and/or pinch points of gates (closures) in silos, bins and hoppers shall be guarded with barrier guards or by location.

**5.3.1.3 Gate (Closure) Actuators.** Guards, shields, or chutes and/or remote actuating devices for gates (closures) on silos, hoppers and bins shall be installed to prevent the employee from being directly in the path of material being discharged.

**5.3.1.4 Conveyors, Bulk Material, Elevators, Turntables.** Equipment shall be installed which complies with mandatory safety standards for that given category of equipment.

**5.3.1.5 Screw or Flight Conveyors, Screens, Coolers, Agitators and Blenders.** Guards shall be installed to prevent entry of persons or reaching into vessels or equipment with internal moving members

**5.3.1.6 Mullers and Mixers.** The blending area of mullers and mixers of sand or other materials shall be fully guarded or guarded by location. All muller or mixer openings shall be guarded to prevent personnel from the foreseeable risk of accidental contact or hazardous approach to machine elements performing the mixing or mulling. Sand or additive entry points or discharge doors shall be guarded by a barrier, screen, cover or other means. Elements protected by virtue of their remote or inaccessible locations shall be considered to be guarded.

**5.3.1.7 Entry into Mullers or Mixers.** Mullers and Mixers are confined spaces and may also be hazardous confined spaces. Refer to OSHA Std. 29 CFR 1910.146 for entry procedures. Refer to OSHA Std. 29 CFR 1910.147 for lockout/tagout procedures.

**5.3.1.8 Sand Sampling.** When equipment is in operation, sand samples shall be taken externally.

**5.3.1.9 Sand Contamination.** Means shall be provided to minimize contamination of sand by tramp metal or debris.

#### **5.3.1.10 Skip Hoists**

**5.3.1.10.1 Skip Hoists, Operating Controls.** When material transfer is manually controlled, the operating controls shall be located so that: (1) the operator is isolated from the transfer mechanism, (2) the operator is not in the path of discharged material, (3) the operator has access to operating controls, (4) The operator has an unobstructed view of the transfer point(s).

**5.3.1.10.2 Skip Hoists, Guarding.** Guards, shields or other devices shall be provided so that the operator or other personnel are isolated from the path of operation of the skip hoist bucket or contact with any of the moving parts. If, by virtue of its location, the drive mechanism is isolated from contact by the operator and others,

**E.5.3.1.2 Gates (Closures).** Injuries may occur when employees attempt to dislodge clinging or bridged material with a mallet or other instrument in one hand while actuating the gate (closure) with the other hand. Guarding against contact between the operator's body (hands primarily) and pinch and/or nip points is the intent of this section.

**E.5.3.1.4 Conveyors, Bulk Material, Elevators, Turntables.** Special attention should be given to spill pans under conveyors, crossing walkways or work areas.

**E.5.3.1.6 Mullers and Mixers.** Unprotected opening(s) encourage personnel to reach into the path of moving machine elements to take sand samples rather than using the sand-sampling device. The intent of this section is to prevent any part of the body from coming into the path of, or between, two or more moving elements or between a moving and a fixed machine element during operation. Secondary protection may be accomplished by electrically interlocking inspection doors to prevent, or interrupt, mixer or muller operation, or padlocking or otherwise preventing the doors from being opened during operation.

**E.5.3.1.9 Sand Contamination.** This can be achieved by magnetic separation and/or screening.

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with the exceptions of authorized maintenance personnel, then it shall be considered to be guarded.

**5.3.1.10.3 Employer Responsibility.** It shall be the responsibility of the employer to provide equipment that complies with mandatory safety standards for that given category of equipment.

**5.3.1.11 Hazardous Substances.** The handling and storage of hazardous substances and the issuance of protective clothing, eyeshields and respirators shall conform with existing standards and regulations.

**5.3.1.12 Threshold Limit Values.** Equipment, operations, and processes producing concentration of any airborne contaminant in excess of current threshold limit values at the operator's breathing zone shall be provided with controls which will reduce the contaminant below the threshold limit value.

**5.3.1.13 Exhaust Systems for Shell Sand Mixers.** Ventilation controls for shell sand mixers shall be provided which will maintain the atmosphere within the mixer less than 25% of the lower explosive limit (LEL).

## 5.3.2 Coremaking

**5.3.2.1 Coremaking Equipment.** Hazardous areas and zones on coremaking equipment shall be guarded by one or more of the methods listed under Section 5.2 of this standard.

**5.3.2.2 Blow Plate and Corebox Seal.** The operator shall be protected from sand that may escape from any joint or parting lines.

**E.5.3.1.10.3 Employer Responsibility.** Refer to ANSI B20.1 Section 6.21, Skip Hoists.

**E.5.3.1.11 Hazardous Substances.** A variety of substances, which might have flammable, explosive and toxic properties, might be used in the preparation of molding sand and core sand. Detailed and individual safety requirements for these substances are considered not to be within the scope of this standard.

**E.5.3.1.12 Threshold Limit Values.** Threshold limit values refer to airborne contaminants and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect. Threshold limit values refer to time-weighted concentrations for an 8-hour workday and 40-hour workweek. They should be used as guides in the control of health hazards and should not be used as fine lines between safe and dangerous concentrations.

**E.5.3.1.13 Exhaust Systems for Shell Sand Mixers.** Shell resins are available in solid form or suspended or dissolved in water or a solvent such as alcohol. The intent of this section is that ventilation not only is required to control any dust generated to a level not exceeding the proper threshold limit value (TLV) for the substance(s) used as established by the American Conference of Governmental Industrial Hygienists, but to assure that additional ventilation is supplied when solvent evaporation might cause an explosion hazard. For additional information, refer to ANSI Z9.2.

**E.5.3.2 Coremaking.** It is not the intent of this section to restrict the materials used in the coremaking operation. Due to the large number of binder chemicals available, the Material Safety Data Sheet for the material used should be consulted for information on possible chemical contaminants in the work environment.

**E.5.3.2.2 Blow Plate and Corebox Seal.** This protection can be accomplished by any one or more of the following means:

- (1) Not permitting magazine faces, blow plates and mating surfaces on coreboxes to become worn to the point where a good mechanical seal cannot be achieved.
- (2) Cleaning loose sand from all mating surfaces before the corebox is blown.
- (3) Use of sealing members between mating surfaces.
- (4) Protective shields or curtains between the operator and machine.
- (5) Good maintenance of vents and blow tubes or slots.

**5.3.2.3 Corebox Handles.** Core blower boxes shall be provided with means for positioning and removal of the box without any portion of the operator's hands exposed to pinch points. When safe gripping points are not naturally provided, they shall be added.

**5.3.2.4 Corebox Pressure.** Coreboxes shall be capable of withstanding the pressure of forces, both mechanical and pneumatic, imposed.

**5.3.2.5 Corebox Vents.** Atmospheric vents shall be provided in either the corebox, the blowplate, or a vent plate below the corebox.

**5.3.2.6 Green Sand Cores.** Molding sand, with bentonite as the binder, can be used for the production of green sand cores.

#### **5.3.2.7 Chemically Activated Core Processes**

**5.3.2.7.1 Heat-Activated Cores.** Personal Protective equipment shall be provided for the operator of a core machine using a heat-activated core process that will protect the operator from contact with the binder chemicals and burns due to the elevated temperatures of the core box or finished cores when exposure is possible. Ventilation will be provided that will maintain a work atmosphere that is within the established limits (TLV, PEL) for contaminants that may be present during the core making process. Review the Material Safety Data Sheet for information on the material with which you are working.

**5.3.2.7.2 Cold Box Cores.** Personal Protective Equipment shall be provided for the operator of a core machine using a cold box process that will protect the operator from contact with the binder chemicals. Ventilation will be provided that will maintain a work atmosphere that is within the established limits (TLV, PEL) for contaminants that may be present during the core making process. Review the Material Safety Data Sheet for information on the material with which you are working.

#### **5.3.3 Molding**

**5.3.3.1 Molding Equipment.** Hazardous areas and zones on molding equipment shall be guarded by one or more than the methods listed under Section 5.2 of this standard.

**E.5.3.2.3 Corebox Handles.** Some coreboxes, by the nature of their height, size and configuration provide safe gripping points for the operator's hands.

**E.5.3.2.4 Corebox Pressure.** It is not the intent of this section to place a restriction either on the materials used for, or the method of, constructing a corebox. A well-constructed core-box for use with either a coreblower or coreshooter allows for simultaneous introduction and exhaust of the air, leaving only compacted sand in the corebox cavity.

**E.5.3.2.7 Chemically Activated Core Processes.** It is not the intent of this section to restrict the materials used in the core making operation. Due to the large number of binder chemicals available, the Material Safety Data sheet for the material used should be consulted for information on possible chemical contaminants in the work environment.

**E.5.3.3.1 Molding Equipment.** Molding equipment covered by this section includes:

- (1) Moldmaking machines
- (2) Flask handling machines
- (3) Rollover machines
- (4) Mold closing machines

In some instances these machines may be interconnected by conveying devices in a progressive manner. In other cases these machines may be located separately from one another and operated individually.



**5.3.3.1.1 Piston Retainers.** The squeeze or jolt pistons of molding machines shall have restraining features to retain the pistons within the cylinders.

**5.3.3.2 Clamp Return.** When gravity chutes used for returning clamps to clamping station(s), the clamps shall be fully contained, and the exit opening(s) guarded.

**5.3.3.3 Slings.** All mandatory standards pertaining to slings are required by this section.

**5.3.3.3.1 Flask Slings.** Flask slings shall be constructed so that adequate clearance is provided or separate handles attached to the legs and/or cross members of a sling or bail to minimize the possibility of pinching body parts.

#### **5.3.3.3.2 Slingers and Mold Filling Machines.**

**5.3.3.3.2.1 Limiting Trajectory.** The head of a mold-filling device shall not be rotated to create a trajectory of sand into a non-confined zone or toward any person.

**5.3.4 Fuel Fired Equipment.** Refer to NFPA 86 "Standard for Ovens and Furnaces."

## **6. Operation of Sand Preparation, Molding and Coremaking Equipment**

### **6.1 Employer's Responsibility**

**6.1.1 Training Operators.** The employer shall train all operators to perform their assigned functions in a manner that will minimize hazards. The training shall include familiarization of the operators with the provisions of this standard which relate to their assigned functions. Operator(s) shall demonstrate to the employer competence to perform the assigned function before starting work on any operation.

**6.1.2 Supervision.** The employer shall enforce established operating procedures.

**6.1.2.1 Actuation of Equipment Controls.** The employer shall be responsible for enforcing a rule that actuation of equipment controls be made only by authorized and qualified personnel.

**6.1.3 Work Area.** Space shall be maintained in each work area so that movement of one operator will not interfere with the work of others.

The floor area of the operator's work area shall be maintained and free of obstructions. Housekeeping procedures shall be established to minimize the accumulation of grease, oil, water and abrasive blasting material.

**6.1.4 Overloading.** The employer shall require that machines and equipment be operated within the capacity ratings.

**E.5.3.3.3 Slings.** Refer to ANSI B30. 9 and OSHA Std. 29 CFR 1910.184 for requirements and recommendations.

**E.5.3.3.3.1 Flask Slings.** Many flasks are rotated in the flask sling to inspect the mold cavity and/or cleanliness of mating flask and mold surfaces.

**E.6.1.1 Training Operators.** The employer should be certain that advisory and caution information plates are understood by all operators. Special attention should be given to non-English speaking operators. Translations may be required. Machine instruction manuals should be explained and made available to operators and maintenance employees.

**E.6.1.2 Supervision.** For those employees who habitually disregard safety rules and correct operating procedures, disciplinary measures should be used.

**E.6.1.3 Work Area.** For additional information regarding walking and work surfaces, refer to mandatory safety standards.

**E.6.1.4 Overloading.** Overloading may result in machine damage or malfunction, and expose the operator to injury.

**6.1.5 Personal Protective Equipment.** The employer shall specify the personal protective equipment required to perform work functions. The employer shall enforce the proper use of this equipment.

## **6.2 Employee's Responsibility**

### **6.2.1 It Shall Be the Responsibility of the Employee(s) To:**

- (1) Follow all safety practices and procedures specified for the functions for which he is responsible.
- (2) Notify his supervisor when he observes unsafe practices or conditions. He shall immediately report any damaged, missing or malfunctioning guards.
- (3) Use personal protective equipment as specified by his employer.
- (4) Refrain from wearing such clothing or jewelry as will be hazardous to his personal safety.
- (5) Maintain an orderly work area.
- (6) Not alter, remove, or disable safety equipment.
- (7) Never initiate a motion that could cause injury or damage.
- (8) Never blow, throw or move material to create a hazard for another person.
- (9) Never remove a lock placed by another person.
- (10) Never alter, block, deface, or obliterate any sign, notice or advisory plate that relates to equipment.
- (11) An operator shall not perform adjustments, make equipment changes, or perform maintenance unless trained and authorized by the employer. Authorized maintenance shall be performed in accordance with Section 4 of this standard.

### **6.2.2 Equipment Adjustments, Changes, and Maintenance Work by Operator**

**6.2.2.1** An operator shall not perform adjustments or make equipment changes that require special precautions unless trained and authorized by the employer to perform these tasks.

**6.2.2.2** An operator shall not perform maintenance tasks unless trained and authorized by the employer to perform these tasks. Such authorized maintenance tasks shall be performed in accordance with Section 4 of this standard.

**E.6.1.5 Personal Protective Equipment.** Included would be equipment such as head and eye protection, foot protection, etc.

(4) When working around moving parts of machines or equipment, loose clothing, neckties, finger rings, necklaces, watch bands, long hair and beards can constitute a hazard.

(11) These employees should be selected on the basis of their aptitude, experience and ability to locate faults and repair or replace improper parts, or controls of equipment.

**E.6.2.2.1** An authorized operator may change patterns, coreboxes, and flasks or adjust or lubricate elements that require "Power -Off." The greater degrees of possible hazard should only be authorized to selected operators.

**E.6.2.2.2** These employees should be selected on the basis of their mechanical aptitude, experience and ability to locate faults and repair or replace improper parts or controls of equipment.